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January 1984 1518-84

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PRESTIGE AND THE INTERORGANIZATIONAL NETWORK IN A POPULATION OF HOSPITALS

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Abstract

In this study we examine the proposition that the prestige of the medical centers in a population of hospitals constrains the scope and extent top which physicians ion teaching hospitals can affiliate with other hospitals in the region. The theory combines elements of research on organizational populations, interorganizational networks and organizational stratification. We find that prestige does influence the stratification system of the hospital population, but in an unexpected way: the effect is dichotomous rather than continuous. The implications for research on populations of organizations is discussed.

Research on interorganizational networks and on populations of organizations have been implicitly intertwined (Aldrich, 1979), For example, Laumaun, Galaskiewicz and Marsden (1978) discuss the problems of defining the boundaries of an interorganizational network in terms of both the function and geographical proximity of the organizations. These organizational attributes may also define an organizational population. On the other hand, DiMaggio and Powell (1983) discuss the properties of organizations in terms of organizational fields, which in turn are defined in terms of the connectedness and structural equivalence (White, Boorman and Breiger, 1976) of the organizations in a network. An organizational field is characterized by the homogeneity of its member organizations in their attributes.

The intertwining of these perspectives is strongest when the members of an organizational population share more than one type of relationship with each other, as in the case of hospitals which share patients and personnel, and band together to plan and pool resources. In such cases a population of organizations may be partitioned robustly into subpopulations based on the structure of the interorganizational network composed of multiple relations. Several studies (Knoke and Rogers, 1979; Walker and Townsend, 1982) have tried to identify subpopulations in this way.

Furthermore, subpopulations may be derived separately for each type of relation and their congruence explained. We take this approach in present research, but with a specific focus linking population characteristics to subpopulation structure.

Here we look at two types of interorganizational relationship in a population of hospitals located in an Eastern U.S. SMSA. The first type of linkage is the affiliation of a hospital with a medical school/center for teaching purposes, and the second type is the sharing of a physician's services by two hospitals. The medical schools in the population vary in their prestige, furthermore; and we predict that the higher the prestige of the medical school/center to which a teaching hospital is attached, the more likely are the doctors in the two institutions to have similar patterns of affiliations with other hospitals in the population. Thus we propose that the prestige of a a hospital's teaching affliation constrains the scope and extent of its doctors' affiliations with other institutions. Since the prestige ordering of the medical schools is a population - level attribute, we focus in this study on how population and subpopulation phenomena are related.

Both prestige and physician affiliations are non-trivial attributes of hospitals. Both Perrow (1961) and DiMaggio and Powell (1983) emphasize the importance of hospital prestige for resource acquisition in a community. In addition, Evan and Walker (1978) found that, in a large SMSA, teaching hospital clusters centered on a medical school/center differed on a number of hospital characteristics and that the differences tended to be explained by the prestige hierarchy of the medical schools. Fennell (1980) points out, furthermore, that the distribution of doctors in a population of hospitals is central to patient flow and therefore to continued viability of the individual organizations.

University medical centers and their teaching hospitals constitute two tiers of organizations in the organizational population. A third tier is composed of those hospitals which are not affiliated with a medical center. There are six medical centers in the population we study, and no teaching hospital is associated with more than one of these. In network terms each of

the six clusters of medical centers and teaching affiliates can be seen as a wheel with medical center at the hub in the teaching affiliates at the ends of each spoke. The affiliation relation differentiates the population both vertically, in that the three tiers of hospitals are distinct and separate, and horizontally, in that the clusters of teaching hospitals around the medical centers are disjoint.

No basis exists for such a differentiation, however, when hospitals are linked by overlapping affiliations of doctors. Medical centers, teaching hospitals and non-teaching hospitals may all share physicians. Physician overlap among hospitals is an interesting example of the kind of interorganizational relation Laumann, Galaskiewicz and Marsden (1980) call "interpenetrating". Interpenetrating relations among organizations are those which violate organizational boundaries and consequently make the issue of organizational boundaries itself problematic. Such relations for non-professional organizations are typically studied at what Parsons (1961) called the "institutional" level, as evidenced by the large number of studies investigating overlap among boards of directors. Professional organizations, however, may share members at both the institutional, managerial and technical levels. Overlapping affiliations of physicians are an example of interpenetration at the technical level of the organization.

Since we focus on professional as opposed to governance level employee overlap among hospitals, we are interested in the professional rather than community resource implications of organizational prestige. Thus, here we are concerned with the prestige assigned to university medical centers by their peers in the professional community nationwide.

The medical centers and their teaching affiliates should share doctors extensively. This kind of physician overlap, is an example of what Laumann and Marsden (1983) called redundancy. By sharing doctors, the medical centers

and teaching affiliate should be able to coordinate the flow of medical students and other resources more effectively than if no common membership existed. Also, doctors with privileges in the medical center and the affiliate may increase the efficiency of formulating and implementing policy changes. By sharing members, the medical center and its teaching affiliates acquire what Ouchi (1980) has called a clan relationship. In a clan relationship, parties to a transaction, here involving the provision of services relating to medical education and research, share common expectations with regard to the achievement of an equitable arrangement over the medium or long term. In the present study, those expectations are common in a trivial sense to the doctor which spans the boundaries of the two organizations.

The pairwise overlap of physicians between a medical center and its teaching affiliates may constrain in some fashion the overall pattern of overlap in the population of hospitals. Laumann and Marsden (1983) point out, however, that at present there is no way of testing such a proposition. Dimaggio and Powell (1983) point out, moreover, that an organization field should be not only internally connected, but also, structurally equivalent in the population of organizations within which it is embedded. Having examined an aspect of connectedness above, we turn now the structural equivalence of the medical centers and their associated teaching hospitals in the network of physician overlaps.

Structural equivalence here involves similarity in the way hospitals are related to all the other hospitals in the network. Why should hospitals which are affiliated with a medical center be structurally equivalent with it and why should differences in the prestige of the medical centers effect the extent of structural equivalence? We answer these questions by looking at the implications of prestige differentiation for the distribution of physicians and other medical resources in the region.

First we consider prestige itself as a resource. Physicians associated with a particular medical center or its teaching affiliates acquire a status by virtue of their affiliation. By affiliating with lesser prestige institutions, doctors in high prestige hospitals lose some of their status. Consequently, hospitals in high prestige clusters may exercise implicit discipline on the professional association of their members whereas doctors affiliated with teaching hospitals allied with less prestigious medical centers should find such discipline less compelling.

As a resource, however, prestige brings with it other resources. Medical centers are generally involved in research activities, and higher prestige accrues to those centers with higher quality and more extensive research. Strong research emphasis in a medical center, or affiliation with high prestige medical centers, should lead to an interest in non-routine cases. Correspondingly, medical centers with fewer research resources should focus on cases closer to the population norm. Non-teaching hospitals should depend more on the teaching hospitals of medical centers in the high prestige clusters for the referral of non-routine cases than on the hospitals in the lower prestige clusters. Assuming that physician affiliations map to a substantial degree the pattern of patient referral, the unequal distribution of medical resources for non-routine care in the population of hospitals should affect the orientation of doctors in their hospital affiliations. Physicians affiliated with high prestige hospitals, should face a relatively different set of affiliation alternatives from physicians in lesser prestige clusters. The argument here is similar to that made by Laumann, Galaskiewicz and Marsden for the existence of opportunity structures which describe the effects of resource inequities in a population of organizations.

The last argument linking membership in a medical center cluster with structural equivalence in the hospital network concerns the recruitment of

physicians. Higher prestige medical centers and their teaching affiliates attract and promote doctors whose training is not local more frequently than lesser prestige clusters (see Evan and Walker, 1978). Higher prestige clusters can be considered cosmopolitan whereas the low prestige clusters are local. Since a physician's affiliation with a hospital depends to some extent on recommendations he or she receives from other physicians, and the network of physicians (as opposed to that of hospitals) is entered during the period of training, the differences in the backgrounds of doctors across the medical school clusters should affect the pattern of their affiliation in the population of hospitals.

For each of the reasons presented above, two types of hypothesis regarding the influence of medical center prestige on the network structure of physician affiliations could be made. The less restrictive hypothesis is that teaching hospitals in higher prestige clusters are structurally equivalent with <u>each other</u> to a greater extent than hospitals in less prestigous clusters. It would be more restrictive to propose that higher prestige leads to the structural equivalence of teaching hospitals and their medical center, which sets the standard for physician behavior in the cluster. In the present research we test the more constrained of these hypotheses, since it is more likely for the effects of prestige to flow from the medical center to the teaching hospitals than across the hospitals themselves.

Data and Methods

The population of 83 hospitals analysed in the present study consists of all hospitals, with more than 30 beds, located in an eight county Eastern SMSA. Six medical schools exist in the region, and the names of their teaching hospitals were gathered through direct inquiry. The sixth medical school taught osteopathic medicine and was ranked last. Thirty-nine hospitals were affiliated with the medical schools for teaching purposes. National presige ranks of five of the medical schools were drawn from a survey of U.S. medical school deans and administrators conducted by Cole and Lipton (1979).

The data on doctor's affiliations with all 83 hospitals were drawn from Dorland's Medical Directory, a documentary source in the public domain. There were 5776 doctors who were affiliated with at least one of the 83 hospitals. An 83 by 83 array of hospitals was constructed whose cell entries consisted of the number of doctors shared by the row and column organizations. To normalize this matrix for hospital size, the cells in each row were divided by the total number of doctors affiliated with the row hospital, thus transforming the entries in the array from counts to proportions.

The matrix was then analysed using CONCOR (Breiger, Boorman and Arabie, 1975; Arabie, Boorman and Levitt, 1979) to derive groups whose member hospitals were structurally equivalent (see White, Boorman and Brieger, 1976). These groups were then cross-classified with the teaching hospital clusters to examine the extent to which the two network-based partitions intersected.

Finally, the cross-classification table of teaching vs. physician groups was analysed using the prediction analysis technique of Hildebrand, Laing and Rosenthal (1977). This technique permitted us to determine how much the information provided by the teaching clusters explained membership in the

hospital groups derived from analysing physician overlaps. Specifically, our hypothesis was that the extent to which teaching hospitals are structurally equivalent with their medical school is a function of the prestige of the latter institution's prestige.

In prediction analysis certain cells in the cross-clasification table are specified as success cells, in which cases are expected to be located due to the theory, and the remainder are error cells. The method provides a measure, ∇ (called del), which indicates the extent to which the theory has predictive validity. Generally, one variable of the table is considered to be the independent variable, and the other the dependent variable. Furthermore, a ∇ measure may be calculated for each state of the independent variable; and here the states are the individual medical center clusters. These state-specific ∇'s provide a first cut at assessing the relative influence of each medical center on the pattern of physician overlaps in its teaching hospitals. Success cells in the present study are those where a structurally equivalent group containing a medical center and that medical center's teaching cluster interset. The number of teaching hospitals which are structually equivalent with the medical center is the entry in the cell.

A problem arises, however. The medical center clusters vary substantially in the number of teaching hospitals they contain. Clearly, the more hospitals in a group, the more likely is it that a certain number of them will be structurally equivalent with the group's medical center. Prediction analysis manages this problem through the concept of precision. The precision of a theory is the sum of the expected values of its error cells, or

$\sum_i \sum_j w_{ij} P_{i\cdot} P_{\cdot j}$, where $w_{ij} = 1$ if the cell is an error cell, and 0 if it is a success cell, and $P_{\cdot i} P_{\cdot j}$ is the product of a cell's marginal probabilities.

Each state on the independent variable contributes $\sum_i w_{ij} P_{i.}$ to the overall precision and dividing the overall precision by the precision of a state provides a normalizing coefficient for that state's ∇ value. (See Hildebrand, Laing and Rosenthal, 1977, pp. 92-96.) In fact, the overall ∇ is the sum across states of the ∇ value for each state times its precision divided by the precision of the theory. This normalization procedure will be used to adjust for the different sizes of the medical center groups.

A last benefit of prediction analysis as a hypothesis testing tool for nominal scale data is the robustness of the ∇ measure to the aggregation of variable categories. Since CONCOR is a splitting algorithm, a question might be raised about the proper level of aggregation of the physician overlap clusters. Prediction analysis as a method makes such a question moot.

Results and Discussion

Table 1 presents the medical center clusters and their prestige ranking, physician overlap clusters and the cross-classification table for these two partitions of the hospital population. In Table 2A the ∇ values for the overall theory and each medical center cluster are presented; Table 2B shows the normalizations of these values for cluster size. Since the clusters are alphabetized in order of prestige, it should be clear that the results in general show a different pattern from that expected. It appears that prestige does not constrain physician affiliations monotonically; rather, three groups of clusters are apparent. The first group consists of Cluster A, the highest prestige cluster in which all teaching hospitals are structurally equivalent with the medical center. The second group is comprised of Clusters B, C, D, and E, which constrain the affiliations of their physicians very little, and the third group is Cluster F, the osteopathic hospitals. The affiliation

Table 1

Medical Center Clusters, Physician Overlap Clusters and Their Cross-Classification

A. Medical Center Clusters

Medical Center	No. of Teaching Hospitals	Prestige Rank
A-	5	1
B-	9	2
C-	11	3
D-	3	4
E-	3	4
F- (osteopathic)	7	5

Number of Non-teaching Hospitals - 38

B. Physician Overlap Clusters

Teaching Hospitals are designated by the letter of their Medical School.
Medical Centers are starred.
Non-teaching Hospitals are designated by an N.

Cluster	Hospitals	Total in Cluster
I	B*BBBCDFNNNN	11
II	F*FFFF	5
III	BBCENNNNNNN	11
IV	BCD*DE*ENNN	9
V	BBCCNNNNNNNN	12
VI	A*AAAAACCENN	11
VII	CDFNNNNN	8
VIII	C*CCFFNNNN	9
IX	BCNNNN	6

C. Cross Classification Table of Medical Center and Physician Clusters

Physician Overlap Clusters	Medical School Clusters A	B	C	D	E	F
I	0	3*	1	1	0	1
II	0	0	0	0	0	4*
III	0	2	1	0	1	0
IV	0	1	1	1*	1*	0
V	0	2	2	0	0	0
VI	5*	0	2	0	1	0
VII	0	0	1	1	0	1
VIII	0	0	2*	0	0	2
IX	0	1	1	0	0	0

Starred cells indicate success cells.
Medical centers are omitted from the table.

Table 2

Prediction Analysis Results

A. Results for Overall Theory and Each Medical Center Group

	∇ of Cluster
Overall Theory	.33
Cluster A	1.0
Cluster B	.21
Cluster C	.08
Cluster D	.26
Cluster E	.26
Cluster F	.58

B. Results Normalized for Medical Center Size

Medical Center Cluster	∇ of Cluster Times Precision of Cluster Divided by Overall Precision
A	.11
B	.04
C	.02
D	.02
E	.02
F	.12

pattern of physicians in the Cluster F hospitals conforms with the theory less well than the pattern of cluster A, but much better than those for middle group of clusters.

Visual inspection of the findings, therefore, makes unnecessary a rank order test of our main hypothesis. The results present a U-shaped relationship between prestige and the structural equivalence of teaching hospitals with their medical centers.

The overall ∇ of .33 indicates that knowledge of membership in the medical school clusters achieves a 33% reduction in error over chance. Clearly, other factors may contribute to the structure of the physician overlap network, such as the geographical proximity of hospitals, and the distribution of medical specialty departments across hospitals. Nonetheless, medical center cluster membership appears to exercise a relatively strong influence on the scope and extent of teaching hospital physician affiliations, and roughly two-thirds of this influence is accounted for by the highest and lowest prestige clusters.

The results suggest that the population of hospitals is sharply stratified rather than monotonically graded as the hypothesis central to this study implies. Research on the stratification of organizations (Stinchcombe, 1965) has been sparse, has typically assigned only community rather than both community and functional boundaries to the population (see e.g., Perrucci and Pilisuk, 1970; Laumann and Pappi, 1976) and has tended to focus on interpersonal rather than interorganizational linkages. The present study therefore contributes to this literature by presenting a stratification system for an organizational population apparently determined to a substantial degree by cluster membership in one type of interorganizational network, that centered on teaching hospital affiliations.

Physicians affliliated with the osteopathic hospitals may have difficulty joining hospitals outside this group because of differences in professional training. The rather strong structural equivalence of the osteopathic cluster may therefore represent the effect of a barrier to entering the regional market for doctors based on professional qualifications. Looking then at results for the five non-osteopathic clusters, we see that the physician affiliation market is relatively unconstrained by membership in the bottom four clusters. Doctors in the top cluster, however, are even more constrained than the osteopaths. The implication of this finding is that medical center prestige either constrains the affiliations of teaching hospital physicians or it doesn't. Defined in terms of its nomological status, therefore, organizational prestige is a binary attribute.

In the present research we have examined how two important types of interorganizational linkage are related to each other in a population of hospitals and explained the relationship by referring to the prestige of clusters defined by one of these types, that of teaching affiliation with a medical school. The study has shown that the relationship is substantial and that the subpopulation of teaching hospitals is stratified into three levels, based on both prestige and, by imputation, barriers to physician affiliation with a hospital, raised by differences in professional training. The market for physicians seems to be least encumbered when neither high prestige nor professional idiosyncracy prevent the consideration by a doctor of his or her full opportunity set. The findings therefore also point to how populations of organizations might be partitioned into relatively free and constained sectors for the flow of goods and services or, as in the present case, of personnel (see Baty, Evan and Rothermel, 1971). Such research would augment the current approach to population studies which treat the organizational environment as stochastic and fundamentally unstructured.

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